

# Benefits of Universal Aggregates Power Project



*Power Plant Improvement Initiative*

Demonstration of Manufactured  
Aggregate Processing Technology

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## Executive Summary

- **Demonstration projects are critical to successful commercialization of technology developed under DOE's Fossil Energy R&D program.**
- **Successful commercial application of Manufactured Aggregate Process could transform almost 25 million tons of currently land filled spray dryer ash by-product to useful lightweight aggregate.**
- **Aggregate is used in manufacturing masonry blocks or lightweight concrete.**



## Universal Aggregates Process

- **Universal Aggregates project at 250 MW Birchwood Power Facility in King George County, Virginia is intended to demonstrate that a material with no current beneficial use, spray dryer by-product, can be turned into useful products.**
- **It will turn 115,000 tons per year of these unwanted by-products into 167,000 tons per year of lightweight aggregate that can be used to make a variety of construction materials, from masonry blocks to lightweight concrete.**
- **Total Project Funding is \$19,581,734.**



Birchwood Power Facility



DOE cost share is \$7,224,000

## Manufactured Aggregate Process

- **Spray Dryer Ash, recycle solids, and water are mixed to generate granular aggregate.**
- **An extruder section is used to intensify mixing and shearing of blended solids.**
- **Wet extrusions are tumbled with additional dry spray dryer by-product material embedding it in aggregate.**
- **Aggregate is then cured in an exothermic process and crushed to a size suitable for construction applications.**



# Unique Contribution of Manufactured Aggregate Process

- This new technology is designed to recycle by-products from either wet or dry scrubbers, thereby lowering costs of waste by-product disposal while reducing environmental liabilities of land filling.
- There are currently 21 spray dryer units producing this difficult to use by-product material.
- It is anticipated that, if proposed multi-pollutant control legislation is enacted, many more spray dryers will be installed to control SO<sub>2</sub> emissions.



# Advantages of Universal Aggregates Process



- Avoidance of waste by-product disposal costs, which vary from \$2-\$30/ton.
- Lower environmental impact; less scrubber by-product to landfill and less aggregate rock to mine.
- Lightweight manufactured aggregate can be sold to concrete block manufactures for profit.
- Manufactured aggregate concrete blocks meet or exceed ASTM specifications, including compressive strength.



## Demonstration Project Objectives

- Demonstrate that commercial-scale capital, fixed and variable operating costs are within estimated values.
- Demonstrate aggregate meets ASTM quality and maintain 24 hour/day production.
- Demonstrate that manufactured aggregate can be used to produce ASTM specification, commercial construction-grade products.



Birchwood Power Facility  
Storage Silo for Spray Dryer  
By-product



Demonstration Project Site





## Estimated Benefits from Commercial Use of Manufactured Aggregate Process

	Birchwood Power Facility	National Target Market
Spray Dryer By-Product Utilization, Tons per year	115,000	1,722,000
Estimated Avoided Lifetime By-Product Disposal, Tons	2,300,000	24,850,000
Estimated Avoided Lifetime By-Product Disposal Cost	\$12,000,000	\$124,250,000



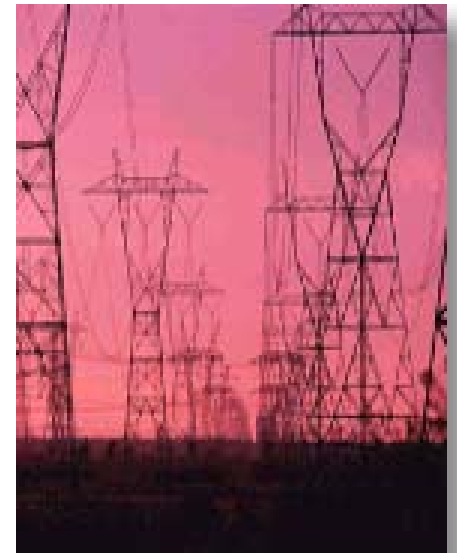
# Approach to Estimating Benefits

- **Forecast market penetration.**
- **Quantify differences between performance of conventional approaches to disposal of spray dryer by-product and Manufactured Aggregate Process being demonstrated.**
  - Amount of spray dryer by-product converted to useful products, tons per year
  - Avoided waste By-Product disposal cost, constant dollars



## Assumed Market Penetration

- Individual boilers with spray dryer FGD facilities were identified by the participant. Size of market was confirmed using NETL's Coal Power Data Base.
- Commercial installation at 13 power generation units is projected based on specific attributes that make them most likely to benefit from **Manufactured Aggregate Process**.
  - Distribution of spray dryer units throughout the country
  - Local market size and selling price



## Assumed Market Penetration (Continued)

- **Specific attributes used to determine generation facilities with greatest potential for manufactured aggregate sales are:**
  - Forecast of significant market for manufactured aggregate
  - Boilers equipped with spray dryer facilities
  - Generating units with high waste disposal costs
  - Location in areas with high construction material demand and limited access to natural aggregate



## Differences in Operating Cost

- Processing fee for disposal of spray dryer by-product is estimated to be \$5 per ton of by-product over lifetime of project.
- Total avoided processing fee for commercialization throughout nation is based upon construction of one Manufactured Aggregate plant per year over a 13 year period.





## Conclusions

- **There are significant benefits to nation that will be realized by commercialization of Manufactured Aggregate Process.**
  - Reduced environmental impact
  - Lower FGD waste by-product disposal costs
  - Aggregate meets or exceeds ASTM specifications for construction materials
  - Sales of a former waste by-product



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